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EXAMINER	
SUAREZ, FELIX E	

ART UNIT	PAPER NUMBER
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NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/594,983	Applicant(s) SAWADA ET AL.	
	Examiner FELIX E. SUAREZ	Art Unit 2857	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 09 August 2007.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-32 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-32 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 29 September 2006 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 08January2007, 09August2007.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-
(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

1. Claims 1-32 are rejected under 35 U.S.C. 102(e) as being unpatentable over Sawada et al. (U.S. Patent No. 7,039,546).

With respect to claims 1, 31 and 32, Sawada et al. (hereafter Sawada) teaches a signal separating apparatus (or program or a computer readable recording medium) which separates mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising:

a frequency domain transforming section which transforms the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain (see col. 1 lines 46-64, a linear array of J sensors is provided; and the estimation of the arrival direction of a signal is made frequently in the frequency

domain. At this end, the observed signal $x_j(t)$ is subject to a short-time Fourier transform to obtain a time series signal $X_j(w,m)$ in the frequency domain);

a normalizing section which normalizes a complex vector generated by using the mixed signals in the frequency domain to generate a normalized vector excluding frequency dependence of the complex vector (see col. 17, lines 1-20, a normalized axis vector calculator 16a normalizes an axis vector which joins the pair of sensor positions to a length of 1); and

a clustering section which clusters the normalized vectors to generate clusters (see col. 23, lines 55-64, an estimation of direction of sound source is made using rows of the INVERSE H(w) frequency domain separation matrix W(w). It is seen that estimated directions are in five clusters, and the cluster located around 150^{o} is larger as twice other cluster).

With respect to claim 2, Sawada further teaches that, the normalizing section comprises:

a first normalizing section which normalizes the argument of each of the elements of the complex vector by using one particular element of the complex vector as a reference (see col. 17, lines 1-20, a normalized axis vector calculator 16a normalizes an axis vector which joins the pair of sensor positions to a length of 1); and

a second normalizing section which divides the argument of each of the elements normalized by the first normalizing section by a value proportional to a

frequency (see col. 17, lines 39-50, a solution which is of a minimum norm type or which achieves least square error is determined and the magnitude is normalized to provide an approximate solution. In this manner, the direction of a straight line which is regarded as being common to a plurality of estimated conical surfaces is determined for each frequency and for each signal source).

With respect to claim 3, Sawada further teaches that, the normalizing section further comprises a third normalizing section which normalizes the norm of a vector consisting of the elements normalized by the second normalizing section to a predetermined value (see col. 17, lines 39-50, a solution which is of a minimum norm type or which achieves least square error is determined and the magnitude is normalized to provide an approximate solution. In other words,

$Ui(w) = V^{+}\, \hat{c}(w)/||V^{+}\hat{c}(w)||$

is calculated in a calculator 16d.

In this manner, the direction of a straight line which is regarded as being common to a plurality of estimated conical surfaces is determined for each frequency and for each signal source).

With respect to claim 4, Sawada teaches, a signal separating apparatus which separates mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising:

a frequency transforming section which transforms the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain (see col. 1 lines 46-64, a linear array of J sensors is provided; and the estimation of the arrival direction of a signal is made frequently in the frequency domain. At this end, the observed signal $x_j(t)$ is subject to a short-time Fourier transform to obtain a time series signal $X_j(w,m)$ in the frequency domain);

a separation matrix computing section which calculates a separation matrix for each frequency by using the mixed signals in the frequency domain (see col. 1 line 64 to col. 2 line 24, in the observed signal $X_j(w,m)$, A(w) is a JxI matrix having a frequency response $A_{ji}(w)$ as elements, and is referred to as a mixture matrix since it represents the frequency response of a signal mixture system; and see col. 4, lines 42-63, blind signal separation);

an inverse matrix computing section which calculates a generalized inverse matrix of the separation matrix (see col. 9, lines 55-60, an inverse matrix of the separation matrix for each frequency is calculated in an inverse matrix calculator);

a basis vector normalizing section which normalizes basis vectors constituting the generalized inverse matrix to obtain normalized basis vectors (see col. 17, lines 1-20, a normalized axis vector calculator 16a normalizes an axis vector which joins the pair of sensor positions to a length of 1);

a clustering section which clusters the normalized basis vectors to generate clusters (see col. 23, lines 55-64, an estimation of direction of sound

source is made using rows of the INVERSE H(w) frequency domain separation matrix W(w). It is seen that estimated directions are in five clusters, and the cluster located around 150^{o} is larger as twice other cluster); and

a permutation computing section which uses center vectors of the clusters and the normalized basis vectors to calculate a permutation used for rearranging the elements of the separation matrix (see col. 24, lines 15-22, accordingly, for frequencies for which signals could have been sorted without contradiction on the basis of the estimated positional information, a permutation matrix is produced on the basis of such information, and for remaining frequencies, the approach which is based on the correlation is used to solve the permutation problem).

With respect to claim 10 Sawada teaches a signal separating apparatus which separates mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising:

a frequency transforming section which transforms the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain (see col. 1 lines 46-64, a linear array of J sensors is provided; and the estimation of the arrival direction of a signal is made frequently in the frequency domain. At this end, the observed signal $x_j(t)$ is subject to a short-time Fourier transform to obtain a time series signal $X_j(w,m)$ in the frequency domain);

a separation matrix computing section which calculates a separation matrix for each frequency by using the mixed signals in the frequency domain

(see col. 1 line 64 to col. 2 line 24, in the observed signal $X_j(w,m)$, A(w) is a JxI matrix having a frequency response $A_{ji}(w)$ as elements, and is referred to as a mixture matrix since it represents the frequency response of a signal mixture system; and see col. 4, lines 42-63, blind signal separation);

an inverse matrix computing section which calculates a generalized inverse matrix of the separation matrix (see col. 9, lines 55-60, an inverse matrix of the separation matrix for each frequency is calculated in an inverse matrix calculator);

a basis vector normalizing section which normalizes basis vectors constituting the generalized inverse matrix to obtain normalized basis vectors (see col. 17, lines 1-20, a normalized axis vector calculator 16a normalizes an axis vector which joins the pair of sensor positions to a length of 1);

a clustering section which clusters the normalized basis vectors to generate clusters (see col. 23, lines 55-64, an estimation of direction of sound source is made using rows of the INVERSE H(w) frequency domain separation matrix W(w). It is seen that estimated directions are in five clusters, and the cluster located around 150^o is larger as twice other cluster); and

a permutation computing section which uses an envelope, the center vectors of the clusters, and the normalized basis vectors to calculate a permutation used for sorting elements of the separation matrix, the envelope being a separated signal obtained from the frequency- domain mixed signals (see col. 24, lines 15-22, accordingly, for frequencies for which signals could

have been sorted without contradiction on the basis of the estimated positional information, a permutation matrix is produced on the basis of such information, and for remaining frequencies, the approach which is based on the correlation is used to solve the permutation problem) and one of the separation matrix and a separation matrix generated by rearranging the separation matrix (see col. 6, lines 32-40, where the number I of signal sources is equal to or greater than 3, a trial-and-error of appropriately rearranging W(w)'s for all frequencies is necessary; and see col.25, lines 60-67, a correct permutation matrix P(w) can be produced to improve a signal to ratio SIR performance of separated signals).

With respect to claims 11 and 29, Sawada teaches a signal separating apparatus (or a method) which separates mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising:

a frequency domain transforming section which transforms the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain (see col. 1 lines 46-64, a linear array of J sensors is provided; and the estimation of the arrival direction of a signal is made frequently in the frequency domain. At this end, the observed signal $x_j(t)$ is subject to a short-time Fourier transform to obtain a time series signal $X_j(w,m)$ in the frequency domain);

a signal separating section which calculates a separation matrix and separated signals for each frequency by using the mixed signals in the frequency

domain (see col. 1 line 64 to col. 2 line 24, in the observed signal $X_j(w,m)$, $A(w)$ is a JxI matrix having a frequency response $A_{ji}(w)$ as elements, and is referred to as a mixture matrix since it represents the frequency response of a signal mixture system; and see col. 4, lines 42-63, blind signal separation); and

a target signal selecting section which normalizes basis vectors (see col. 17, lines 1-20, a normalized axis vector calculator 16a normalizes an axis vector which joins the pair of sensor positions to a length of 1) which are columns of a generalized inverse matrix of the separation matrix (see col. 18, lines 10-35, a permuted matrix which moves or permutates columns in this manner is produced), clusters the normalized basis vectors (see col. 23, lines 55-64, an estimation of direction of sound source is made using rows of the INVERSE H(w) frequency domain separation matrix W(w). It is seen that estimated directions are in five clusters, and the cluster located around 150^o is larger as twice other cluster), and selects selection signals including a target signal from among the separated signals by using the variance of the clusters as an indicator (see col. 17, lines 39-45, a minimum norm type or which achieves least square error is determined and the magnitude is normalizes to provide an appropriate solution).

With respect to claims 22 and 30, Sawada teaches a signal separating apparatus (or a method) which separates mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising:

a frequency transforming section which transforms the mixed signals observed by a plurality of sensors into mixed signals in the frequency domain (see col. 1 lines 46-64, a linear array of J sensors is provided; and the estimation of the arrival direction of a signal is made frequently in the frequency domain. At this end, the observed signal $x_j(t)$ is subject to a short-time Fourier transform to obtain a time series signal $X_j(w,m)$ in the frequency domain);

a vector normalizing section which normalizes a mixed-signal vector consisting of the mixed signals in the frequency domain to obtain a normalized vector (see col. 17, lines 1-20, a normalized axis vector calculator 16a normalizes an axis vector which joins the pair of sensor positions to a length of 1);

a clustering section which clusters the normalized vector to generate clusters (see col. 23, lines 55-64, an estimation of direction of sound source is made using rows of the INVERSE H(w) frequency domain separation matrix W(w). It is seen that estimated directions are in five clusters, and the cluster located around 150^o is larger as twice other cluster); and

a separated signal generating section which extracts a predetermined ordinal number- th element of the mixed-signal vector corresponding to the time-frequency of the normalized vector that belongs to the k-th cluster and generates a separated-signal vector having the element as the k-th element (see col. 3, lines 21-35, considering an i-th row of the separation matrix W(w), an analysis can be made to see what is the direction in which the oncoming signal is

extracted and what is the direction in which the oncoming signal is suppressed).

With respect to claims 5, 16 and 23, Sawada further teaches that, the basis vector normalizing section performs normalization that eliminates frequency dependence from the basis vectors (see col. 17, lines 1-20, a normalized axis vector calculator 16a normalizes an axis vector which joins the pair of sensor positions to a length of 1. In other words

Vp = dj(p) –dj'(p)/||dj(p)-dj'(p)||).

With respect to claims 6, 17 and 24, Sawada further teaches that, the normalization that eliminate frequency dependence from the basis vectors normalize the argument of each element of each of the basis vectors by using one particular element of the basis vector as a reference and divides the argument of each element by a value proportional to a frequency (see col. 17, lines 39-50, a solution which is of a minimum norm type or which achieves least square error is determined and the magnitude is normalized to provide an approximate solution. In other words,

$Ui(w) = V^{+}\,\hat{c}(w)/||V^{+}\hat{c}(w)||$

is calculated in a calculator 16d.

In this manner, the direction of a straight line which is regarded as being common to a plurality of estimated conical surfaces is determined for each

frequency and for each signal source).

With respect to claims 7, 18 and 25, Sawada further teaches that, the normalization that eliminates frequency dependence from the basis vectors is performed by calculating

[Formula 64]

$$A_{qp}'(f) = \left|A_{qp}(f)\right| \exp\left[j \frac{\arg\left[A_{qp}(f)/A_{QP}(f)\right]}{4fc^{-1}d} \right]$$

for each element Aqp(f) (where q = 1, ..., M and M is the number of sensors observing the mixed signals) of the basis vectors Ap(f) (where p = 1, ..., N and N is the number of signal sources), where exp is Napier's number, arg[.] is an argument, f is a frequency, j is an imaginary unit, c is signal transmission speed, Q is a reference value selected from natural numbers less than or equal to M, and d is a real number (see col. 11, lines 30-50, accordingly, using an amplitude attenuation factor α_{ji} (a real number and a phase difference exp(jΦi) at the origin, a different model $A_{ji}(w)= \alpha_{ji} \exp(j\Phi_i)\exp(jwc^{-1}d_j \cos\theta)$ is used; and see col. 15, lines 28-38,

$\cos\theta= \arg[H_{ji}(w)/H_{j'i}(w)] / (wc^{-1} ||d_j- d_{j'}||)$, where $||d_j- d_{j'}||$ represents a spacing or distance between sensors 1_j and $1_{j'}$).

With respect to claims 8, 19 and 26, Sawada further teaches that, "d" is the maximum distance dmax between a reference sensor corresponding to the element AQp(f) and another sensor (see col. 15, lines 28-38,

$\cos\theta = \arg[H_{ji}(w)/H_{j'i}(w)] / (wc^{-1} ||d_j - d_{j'}||)$, where $||d_j - d_{j'}||$ represents a spacing or distance between sensors 1_j and $1_{j'}$).

With respect to claims 9, 20 and 27, Sawada further teaches that, the basis vector normalizing section performs normalization that eliminates frequency dependence from the basis vectors (see col. 17, lines 1-20, a normalized axis vector calculator 16a normalizes an axis vector which joins the pair of sensor positions to a length of 1. In other words

$Vp = dj(p) – dj'(p)/||dj(p)-dj'(p)||$) and normalization that normalizes the norms of the basis vectors to a predetermined number (see col. 17, lines 39-50, a solution which is of a minimum norm type or which achieves least square error is determined and the magnitude is normalized to provide an approximate solution. In other words,

$Ui(w) = V^{+} \hat{c}(w)/||V^{+}\hat{c}(w)||$

is calculated in a calculator 16d.

In this manner, the direction of a straight line which is regarded as being common to a plurality of estimated conical surfaces is determined for each frequency and for each signal source).

With respect to claim 12, Sawada further teaches, comprising:

a mask generating section which generates a time-frequency mask by using the mixed signals in the frequency domain and the basis vectors (see col. 1 lines 46-64, a linear array of J sensors is provided; and the estimation of the arrival direction of a signal is made frequently in the frequency domain. At this end, the observed signal $x_j(t)$ is subject to a short-time Fourier transform to obtain a time series signal $X_j(w,m)$ in the frequency domain where w represents an angular frequency ($w=2\pi f$ where f represents a frequency) and m is a number representing time); and

a masking section which applies the time-frequency mask to the selection signals selected by the target signal selecting section to generate masked selection signals (see col. 1 line 64 to col. 2 line 24, in the observed signal $X_j(w,m)$, $A(w)$ is a JxI matrix having a frequency response $A_{ji}(w)$ as elements, and is referred to as a mixture matrix since it represents the frequency response of a signal mixture system; and see col. 4, lines 42-63, blind signal separation);.

With respect to claim 13, Sawada further teaches that, the mask generating section comprises:

a whitening matrix generating section which generates a whitening matrix by using the mixed signals in the frequency domain (see col. 1 lines 46-64, a linear array of J sensors is provided; and the estimation of the arrival direction of a signal is made frequently in the frequency domain. At this end, the observed

signal $x_j(t)$ is subject to a short-time Fourier transform to obtain a time series signal $X_j(w,m)$ in the frequency domain where w represents an angular frequency ($w=2\pi f$ where f represents a frequency) and m is a number representing time);

a whitening section which uses the whitening matrix to transform a mixed-signal vector consisting of the mixed signals in the frequency domain into a whitened mixed-signal vector and to transform the basis vectors into whitened basis vectors (see col. 1 line 64 to col. 2 line 24, in the observed signal $X_j(w,m)$, A(w) is a JxI matrix having a frequency response $A_{ji}(w)$ as elements, and is referred to as a mixture matrix since it represents the frequency response of a signal mixture system; and see col. 4, lines 42-63, blind signal separation);;

an angle computing section which computes the angle between the whitened mixed- signal vector and the whitened basis vector for each time-frequency (see col. 15, lines 28-38,

$\theta = \cos^{-1}\{ \arg[H_{ji}(w)/H_{j'i}(w)] / (wc^{-1} \|d_j - d_{j'}\|) \}$, where $\|d_j - d_{j'}\|$ represents a spacing or distance between sensors 1_j and $1_{j'}$); and

a function operation section which generates the time-frequency mask which is a function including the angle as an element (see col. 15, lines 62-67, calculations which take place at step S26 are made at step S4c, S4d, S4e and S4f in FIG. 8 by using the argument calculator 14b, the spacing calculator 14c, the phase rotation calculator 14d, the divider 14e, the decision unit 14f and the arccosine calculator 14g shown in FIG. 7).

With respect to claim 14, Sawada further teaches that, the whitening matrix is $V(f) = R(f)^{-1/2}$, wherein $R(f) = < X(f,t).X(f,t)^H >t$, f is a frequency, t is discrete time, X(f, t) is the mixed-signal vector, < * > is a time-averaged vector of a vector "*", and "$*^H$" is a complex conjugate transposed vector of the vector "*" (see col. 2, lines 1-24, where

$X(w,m) = [X_I(w,m), \ldots, X_J(w,m)]^T$;

$S(w,m) = [S_I(w,m), \ldots, S_J(w,m)]^T$

are vector representation of observed signals by J sensors and I source signals. Denotation $[a]^T$ represents the transposition of a vector or matrix a);

the whitening section calculates the whitened mixed-signal vector Z(f, t) as Z(f, t) = V(f).X(f, t) and calculates the whitened basis vector B(f) as B(f) = V(f).A(f) where the basis vector is A(f) (see col. 2, lines 1-25,

$$X_j(w,m) = \sum_{i=1}^{I} A_{ji}(w) S_i(w,m)$$ w is function of frequency f and m is discrete time value;

the angle computing section calculates the angle θ(f, t) as $\theta(f, t) = \cos^{-1}(I\, B^H(f)\text{-}Z(f,t)|/||B(f)||\ .\ ||z(f,t)||)$, where I*| is the absolute value of a vector "*" and ||*|| is the norm of the vector "*" (see col. 15, lines 28-38,

$\theta = \cos^{-1}\{ \arg[H_{ji}(w)/H_{j'i}(w)] / (wc^{-1}\ ||d_j\text{-}\ d_{j'}||) \}$, where $||d_j\text{-}\ d_{j'}||$ represents a spacing or distance between sensors 1_j and $1_{j'}$); and

the function operation section calculates a logistic function M(θ(f, t)) = $\alpha/(1+e^{\,g(\theta(f',t)\text{-}\ \theta T)})$ as the time-frequency mask, where α, g, and θ_T are real numbers (see col. 11 lines 40-55, alternatively, the angle $\theta_i(wn)$ may be

determined for each column and for each inverse matrix $H(w_n)$ for a plurality of frequencies or every frequency in H(w) in the manner mentioned above, and individual arrival directions may be determined on the basis of the whole assembly of these angles).

With respect to claim 15, Sawada further teaches that, the mask generating section comprises:

a frequency normalizing section which normalizes a mixed-signal vector X(f, t) generated by using the mixed signals in the frequency domain to a frequency-independent frequency-normalized vector X'(f, t) (see col. 17, lines 33-50, as shown in FIG. 16, a normalized axis vector for each sensor pair which is used in the estimation of a conical surface in the normalized axis vector calculator 16a is determined);

a first norm-normalizing section which normalizes the frequency-normalized vector X'(f, t) to a norm-normalized vector X"(f, t) whose norm has a predetermined value (see col. 17, lines 33-50, a solution which is of a minimum norm type or which achieves least square error is determined and the magnitude is normalized to provide an appropriate solution. In other words,

$Ui(w) = V^{+} \hat{c}(w)/||V^{+}\hat{c}(w)||$

is calculated in a calculator 16d.

In this manner, the direction of a straight line which is regarded as being common to a plurality of estimated conical surfaces is determined for each frequency and for each signal source);

a centroid selecting section which extracts centroids η_l corresponding to the selection signals (see col. 3, lines 50-55, it is apparent from this that the first row of the separation matrix extracts a signal oncoming from 121^o while suppressing a signal oncoming from 55^o; and see col. 15, lines 38-42, accordingly, positional information of individual sensors are represented by two or three element coordinate vector having an origin at the center of a circle on which sensors 1_1 to 1_4 are disposed);

a second norm-normalizing section which normalizes the centroids η_l corresponding to the selection signals to norm-normalized centroids η_l whose norm has a predetermined value (see col. 17, lines 33-50, a solution which is of a minimum norm type or which achieves least square error is determined and the magnitude is normalized to provide an appropriate solution. In other words,

$Ui(w) = V^+ \hat{c}(w)/||V^+\hat{c}(w)||$

is calculated in a calculator 16d.

In this manner, the direction of a straight line which is regarded as being common to a plurality of estimated conical surfaces is determined for each frequency and for each signal source);

a squared distance computing section which calculates the square DS(f,t) of the distance between the frequency-normalized vector X'(f, t) and the norm-

normalized centroids η_l' (see col. 17, lines 33-50, a solution which is of a minimum norm type or which achieves least square error is determined and the magnitude is normalized to provide an appropriate solution); and

a function generating section which generates the time-frequency mask using a function including the square of the distance DS(f, t) as an element (see col. 15, lines 62-67, calculations which take place at step S26 are made at step S4c, S4d, S4e and S4f in FIG. 8 by using the argument calculator 14b, the spacing calculator 14c, the phase rotation calculator 14d, the divider 14e, the decision unit 14f and the arccosine calculator 14g shown in FIG. 7).

With respect to claim 21, Sawada further teaches that, the target signal selecting section selects a cluster (see col. 23, lines 55-64, an estimation of direction of sound source is made using rows of the INVERSE H(w) frequency domain separation matrix W(w). It is seen that estimated directions are in five clusters, and the cluster located around 150^o is larger as twice other cluster) that provides the minimum variance and selects separated signals corresponding to the selected cluster as the selection signals (see col. 17, lines 39-45, a minimum norm type or which achieves least square error is determined and the magnitude is normalizes to provide an appropriate solution)..

With respect to claim 28, Sawada teaches a signal separating method for separating mixed signals consisting of a mixture of source signals originated from a plurality of signal sources into the source signals, comprising the steps of:

transforming the mixed signal observed by a plurality of sensors into mixed signals in the frequency domain and outputting the transformed mixed signals (see col. 1 lines 46-64, a linear array of J sensors is provided; and the estimation of the arrival direction of a signal is made frequently in the frequency domain. At this end, the observed signal $x_j(t)$ is subject to a short-time Fourier transform to obtain a time series signal $X_j(w,m)$ in the frequency domain);

calculating a separation matrix for each frequency by using the mixed signals in the inputted frequency-domain (see col. 1 line 64 to col. 2 line 24, in the observed signal $X_j(w,m)$, A(w) is a JxI matrix having a frequency response $A_{ji}(w)$ as elements, and is referred to as a mixture matrix since it represents the frequency response of a signal mixture system; and see col. 4, lines 42-63, blind signal separation);

calculating a generalized inverse matrix of the inputted separation matrix and outputting the calculated generalized inverse matrix (see col. 9, lines 55-60, an inverse matrix of the separation matrix for each frequency is calculated in an inverse matrix calculator);

normalizing basis vectors constituting the inputted generalized inverse matrix to obtain normalized basis vectors (see col. 17, lines 1-20, a normalized

axis vector calculator 16a normalizes an axis vector which joins the pair of sensor positions to a length of 1);

clustering the inputted normalized basis vectors to generate and output clusters (see col. 23, lines 55-64, an estimation of direction of sound source is made using rows of the INVERSE H(w) frequency domain separation matrix W(w). It is seen that estimated directions are in five clusters, and the cluster located around 150^{o} is larger as twice other cluster); and

using the center vectors of the inputted clusters and the normalized basis vectors (see col. 15, lines 38-42, accordingly, positional information of individual sensors are represented by two or three element coordinate vector having an origin at the center of a circle on which sensors 1_1 to 1_4 are disposed) to calculate a permutation used for rearranging elements of the separation matrix and outputting the calculated permutation (see col. 6, lines 32-40, this method of solving the permutation problem requires a high computational cost in determining minimum gains of directivity patterns, and in addition, where the number I of signal sources is equal to or greater than 3, a trial-and-error of appropriately rearranging W(w)'s for all frequencies is necessary).

Conclusion

Prior Art

2. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Sawada et al. [U.S. Patent Application Publication No. 2005/0203981] describes a position information estimation device.

Araki et al. [U.S. Patent Application Publication No. 2006/0058983] describes a clustering unit and mask control unit.

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Felix Suarez, whose telephone number is (571) 272-2223. The examiner can normally be reached on weekdays from 8:30 a.m. to 5:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eliseo Ramos-Feliciano can be reached on (571) 272-7925. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300 for regular communications and for After Final communications.

January 26, 2009

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